Infant malnutrition and maternal mental health in home based care

Moezna Jacobs

Presented in fulfilment of the requirements for the degree of

Master of Philosophy in Infant Mental Health

Department of Psychiatry

Faculty of Medicine and Health Sciences

Stellenbosch University

Primary supervisor

Dr Anusha Lachman

Department of Psychiatry

Co-supervisors

Dr Evette Van Niekerk

Department of Global Health, Division of Human Nutrition

Date

March 2021

Declaration

By submitting this thesis, I declare that the entirety of the work contained therein is my own, original work, that I am the sole author thereof (save to the extent explicitly otherwise stated), that reproduction and publication thereof by Stellenbosch University will not infringe any third party rights and that I have not previously in its entirety or in part submitted it for obtaining any qualification.

This dissertation includes 1 publication-ready manuscript. The development and writing of the paper (unpublished) was the principal responsibility of myself.

Signed:

Date: 23 February 2021

Table of Contents

Extended literature review

Since 2010 emphasis has been put on the 1st 1000 days which is the period from conception until the child's second birthday (1). This initiative was launched by Hilary Clinton along with The Hunger Project and since then much research has emerged on this time period of the child's life (2,3). Some of the available research has a general focus while other research is more specific but the concluding evidence shows that experiences during this critical period have lifelong consequences (3). The 1st 1000 days of a child's life has been identified as a crucial period for childhood growth and development and carries the potential for lifelong health, prevention of diseases and cognitive development (4). Childhood growth is determined by many factors including, but not limited to, environmental factors, genetics, nutrition and maternal mental health (5). Infants in their first 1000 days of life are completely dependent on their caregivers which increases their risk of malnutrition and when the mother has poor mental health such as depression and anxiety, she is unable to adequately care for the infant (6). This inadequate care counts as an experience that could possibly have lifelong consequences (3).

Maternal mental health is of critical importance in the early years of childhood due to the impact on short and long term outcomes for the child and the caregiver (7). The term peripartum depression encompasses a range of symptoms that can affect women during pregnancy up until one year post-partum (5). Symptoms include depressed mood, tiredness, insomnia, low self-esteem and lack of interest in the environment (8). Maternal depression has been highlighted as a global public health issue due to its high prevalence (9).

Researchers have reported that 10-15% of all mothers in higher income countries (HIC) are estimated to suffer from depression (10). As reported in a study by the WHO the prevalence of postnatal disorders in lower middle income countries (LMIC) is 19.8% (11). In South Africa it is estimated that common peri-natal mental disorders (CPMD's, like anxiety and depression) affect 21-39% of mothers (10). Research conducted in a peri-urban community in Cape Town, Khayelitsha, indicated that 16-35% of women experience depression in the postpartum period (12).

Herba et al (2016) suggest that the risk factors for maternal depression include, but are not limited to, exposure to violence, food insecurity, sanitation deficiencies and shortage of good accessible healthcare. Turner and Honikman (2017) further propose that these risk factors are more social than biological and are exacerbated by poverty. South African caregivers,

especially those situated in previously economically disadvantaged areas, experience many compounding risk factors such as poverty, intimate-partner violence, HIV, and low levels of education (13). Maternal mental health has been proven to be a vital component for the developing foetus and the raising of healthy children (7). The combination of women's vulnerability to depression, their responsibility of childcare and the high prevalence of maternal depression suggests that maternal mental health could have a significant effect on the growth of children (7). Evidence suggests that maternal depression affects childhood growth through interfering with the quality of emotional childcare, the mother-child attachment or negatively affecting mother's health promoting behaviours' and basic childcare practices (6). Depressed mood among women in the postnatal period has been associated with elevated risks for diarrhoea and poorer growth outcomes among new born infants (12).

A study was conducted in Khayelitsha, a local low income densely populated community, in a Primary Health Care (PHC) setting and this study showed that 39% of mothers experienced one risk factor for depression while 27% experienced two or more risk factors (12). In the study conducted by Tomlinson et al (2014) pregnant women attending a PHC clinic were screened for anxiety and depression initially, and follow up screening was done as part of a Home based Care Program. These results showed a depression prevalence of 43%. Tomlinson et al (2014) suggested that the results of these studies suggest that the model of care is vertical and there is a need to integrate maternal mental health services into the PHC platform. The vertical approach calls for solutions for a given health problem by means of a single-purpose machinery. The goal of this approach might be to treat or eradicate a single disease by vaccination or disease-specific campaigns. An example of this is the TB/HIV programme, where the focus is only to manage patients with this disease but does not take into consideration other co-morbidities or nutritional needs. The integrated approach seeks to tackle the over-all health problems on a wide front and on a long-term basis through the creation of a system of permanent institutions commonly known as 'general health services'. The goal of this approach is to focus on building health care systems that are able tackle diseases in a long-term manner and may cut across specific diseases. Examples of these types of approaches, with regards to health services, include an integrated approach by including mental health screening to an existing maternal and child health programme. Part of integration of health care services is to decrease maternal and childhood mortality (14). Turner and Honikman (2017) also state that only 20-25% of mothers with maternal depression access adequate mental health services in South Africa.

To support rapid growth and development, the nutritional demands are high during first 1000 days of life (6). How well children are nourished will impact the child's ability to learn, grow and thrive (2). However, high rates of poverty and food insecurity in LMICs means that many children do not receive adequate nutrition (15). These are also risk factors for maternal depression (16). This inadequate nutrition, often in conjunction with poor maternal mental health could result in poor growth outcomes (16).

Table 1 depicts the various studies that have shown associations between maternal depression and compromised child growth in Low – Middle Income Countries (LMICs).

Table 1: Previous evidence on Maternal Mental health and childhood growth outcomes

Author	Study setting	Description of mothers	Data on depression	Nutritional status of children
(Avan, et al., 2010)	Soweto, Johannesburg Socioeconomically deprived urban setting	85% African, 91% <35 years of age, most households had basic amenities	24% mothers depressed (Pitt Inventory)	3% underweight 16% stunted
(Surkan, et al., 2011)	Meta-analysis restricted to developing countries	Africa – 4 studies South America – 6 studies Southern Asia – 6 South-east Asia – 1	23% (*EPDS)	30% underweight 25% stunted
(Wemakor & Mensah, 2016)	Tamale (capital city), Northern Ghana	Mean 27 years, 64% had no education, 81% were married	27.8% (EPDS)	8.9% underweight 16.1% stunted
(Motlhatledi, et al., 2017)	2 PHC clinics in Mahalapye, Botswana	24% population unemployed 8 mothers completed tertiary education, mean age was 34 years	28% (**PHQ 9)	Association between Maternal depression and malnutrition shown
(Madlala & Kassier, 2018)	Peer reviewed articles	KZN: rural area, 45% RVD+ teenagers CT: Peri-urban settlement	KZN : 47% CT: 34.7%	Association between Maternal depression and malnutrition shown
Tsai et al, 2004	Peri urban settlement in Khayelitsha	147 mothers assessed postnatally black African women	35% met criteria for major depressive disorder	Two fold increase risk of underweight

*EPDS – Edinburgh Postnatal Depression Scale **PHQ 9 – Patient Health Questionnaire -9 questions

Based on the evidence from the research conducted in Khayelitsha, maternal depression has an effect on the growth outcomes of the infants in Primary Health Care settings (12). However, there is a need for further comprehensive research in other communities on maternal mental health and growth outcomes in infants

Poor growth outcomes can be classified as malnutrition. Poor growth outcomes, for the purpose of this study, is classified as malnutrition. Malnutrition can be considered as either being underweight, stunted or overweight. Micronutrient malnutrition can also occur, however, it was not part of this study. Underweight is one form of malnutrition and can be caused by a variety of factors including poor nutrition and poverty. The consequences of underweight include increased infections and an increased risk of mortality. Stunting is considered a form of chronic malnutrition and often becomes irreversible after the first 1000 days of life. Stunting is often overlooked as it is not as apparent as underweight in the appearance of the child. Consequences of stunting include delayed brain development, poor immunity and a high risk of obesity in adulthood due to low stature (17). In addition to under nutrition, the rates of overweight and obesity have increased in LMICs. LMICs now have a double burden of disease, under and over nutrition, in the same age group. Overweight is caused by increased caloric and fat intake as well as increased portion sizes and a steady decline in physical activity. Consequences of overweight in childhood include poor physical health, poor social and emotional wellbeing, poor academic performance and a lower quality of life (18). Childhood malnutrition, which includes underweight and stunting is a risk factor for childhood mortality and causes close to 50% of childhood deaths worldwide (19).

The possible pathway from maternal depression to childhood malnutrition is depicted in Figure 1. The UNICEF conceptual framework is a tool used to describe the various pathways of malnutrition in children. This figure shows poverty as an underlying cause for poor maternal mental health which could then result in inadequate care for the child as well as limited usage of health services. These outcomes eventually result in malnutrition as the child might be exposed to infections and/or have poor nutrition.

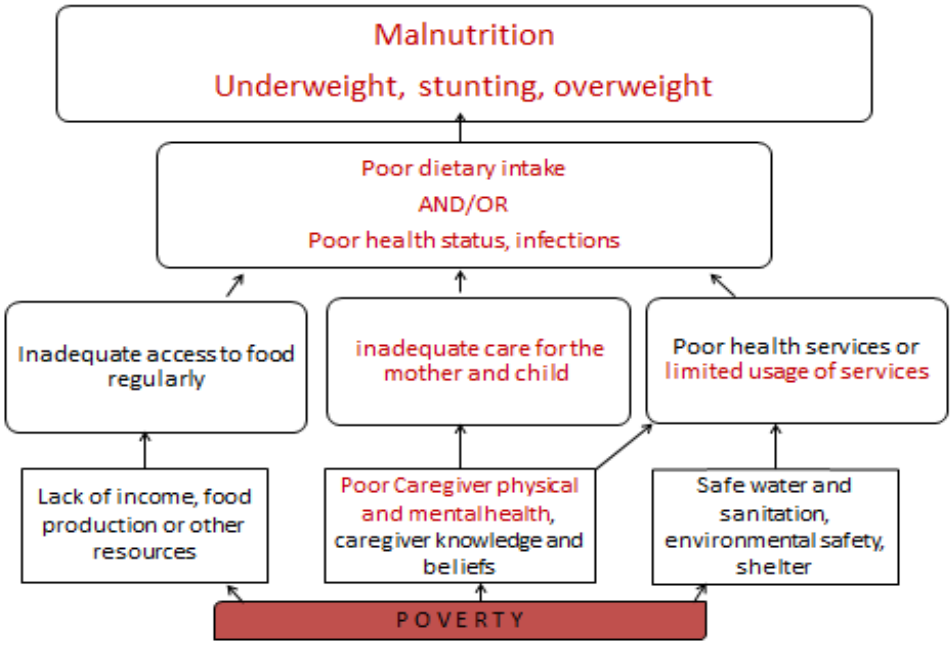

Figure 1: Based on the UNICEF Conceptual framework of Malnutrition, showcasing maternal mental health and the link to malnutrition (UNICEF, 1990).

Much of the existing global research in childhood growth and maternal depression has taken place in rural areas where participants come from a low socioeconomic status and they attend primary health care clinics (6,20). In SA the settings and results have varied (7,12,21) One research series was conducted in Khayelitsha in a Primary Health Care (PHC) setting. These researchers suggests that there is a great need to implement services in a PHC setting outside of the clinic and to integrate maternal mental health interventions into existing programs like home based care (12). Home-based care (HBC) was established in the early 2000s in South Africa as part of the re-engineering of PHC services. The thought behind HBC or Ward Based Outreach Teams was that this service would relieve some of the burden off of the PHC clinics. The focus of this kind of care is prevention and promotion as well as increased access to health services by linking with other community organizations. Ward based teams comprise of nursing co-ordinators and CHWs that are linked to a health facility in the area that is being serviced (22). Home based care in South Africa has been established as part of the Primary Health Care engineering plan. The aim of this plan is to transform the health system and strengthen the PHC platform. Part of this transformation is the creation of ward based outreach teams (WBOT) which has a specific focus on improving maternal and child health (23). Screening for maternal depression in home based care settings has been shown to be beneficial with the addition of training lay health community workers on maternal mental health (20,24). Previous evidence looks at mothers who were screened during the antenatal period for depression and then

followed up by CHWs in the postnatal period (24,25) . There is however insufficient evidence that looks at screening all mothers that receive home/community based care in the greater Metro pole district area (26).

Publication-ready manuscript

The following manuscript has been prepared for submission to South African Journal of Clinical Nutrition. The journal's aims and scope, as well as author guidelines are given in Appendix A.

Infant malnutrition and maternal mental health in home based care

Full author details

Moezna Jacobs, Registered Dietitian, Department of Psychiatry, Faculty of Medicine and Health Sciences, Stellenbosch University, South Africa. Email: ORCID ID: https://orcid.org/0000-0002-1537-2822

Dr Evette Van Niekerk, Senior lecturer, Department Global Health, Division of Human Nutrition, Faculty of Medicine and Health Sciences, Stellenbosch University, South Africa. Email: ORCID ID: https://orcid.org/0000-0003-3960-7320

Dr Anusha Lachman consultant and senior lecturer, Department of Psychiatry, Faculty of Health Sciences, Stellenbosch University, South Africa. Email: .

ORCID ID: https://orcid.org/0000-0002-7593-2916

Corresponding author

Dr Anusha Lachman

Address: Department of Psychiatry, Faculty of Medicine and Health Sciences, Stellenbosch University, PO Box 241, Cape Town, South Africa, 8000.

Tel: +

Email:

Abstract

Background: Maternal mental health is of critical importance in the early years of childhood due to its impact on the short and long term outcomes of the child and the caregiver. The combination of women's vulnerability to depression and their responsibility of childcare suggests that maternal mental health could have a significant effect on the growth of children.

Objectives: This study sought to describe the mental health status of mothers receiving home based care in the Nomzamo area in the Helderberg basin of the Cape Metropole, and to determine whether there were higher rates of malnutrition in infants 0-24 months amongst mentally-ill mothers compared to well mothers

Design: A descriptive, quantitative, cross-sectional study was conducted and included mothers taking care of 0-24 month old infants, receiving home based care.

Outcome measures: Maternal Mental health was screened using the PHQ 9, GAD 7 and 3 CPMD questionnaire. Infant weight-for-age, height-for-age and weight-for-height z-scores were measured.

Results: 14% of mothers experienced symptoms of anxiety, 22% experienced symptoms of depression and 18% of mothers had a suicide risk. The majority of infants (86%) had a normal weigh-for-age, and a normal height-for-age (90%). We found no association between malnutrition and maternal health. There were significant associations between depression and male infant gender, marital status, accommodation and level of education of the mothers.

Conclusions: Maternal mental health rates were consistent with previous studies done in Western Cape and LMICs. The rates of malnutrition were lower than expected and this could be attributed to the support given by community health workers. There were no positive associations found between maternal mental health and malnutrition in this sample. Further research is needed in this area.

Introduction

Poor maternal mental health has become an important area of research given the high rates of depression during childbearing years. Studies have shown that 10-15% of all mothers in higher income countries suffer from depression (10). In South Africa, it is estimated that common perinatal mental disorders (CPMD's), like anxiety and depression, affects 21-39% of mothers (10). In Khayelitsha, Cape Town, a densely populated township area, the prevalence of depression in mothers was reported to be between 16-35% (12).

In addition to the high rates of depression, studies have shown that there is an association between poor maternal mental health and poor growth outcomes in children (27). Maternal depression has been shown to affect the mothers' ability to interact and care for her child, resulting in poor care practices, insufficient or incorrect nutrition and ultimately infections and malnutrition (6). This is a concern as mothers often experience depression during the most critical stage of their child's early development, the "1st 1000 days" (6). The 1st 1000 days of a child's life – which spans from conception until 2 years of age, has been identified as a crucial period for optimal growth and development. Insufficient care, nutrition and stimulation during this period may result in adverse outcomes in the infant (28).

Much of the existing global research on childhood growth and maternal depression has taken place in rural areas where participants come from a low socioeconomic status and they attend primary health care clinics (6). Several studies have contributed to our understanding of maternal depression and childhood growth in the South African context (7,12,21). However, most of this research has been limited to a specific geographical location, Khayelitsha, Cape Town, limiting our understanding of maternal depression and child growth in broader urban communities across the Cape Town Metropole, other areas in the Western Cape, and in South Africa as a whole. In addition, the results have varied across the different clinical settings (7,12,21). The researchers from these studies suggest there is a great need to implement services in a Primary Health Care (PHC) setting and to integrate maternal mental health interventions into existing programs (12). Screening for maternal depression has also been shown to be beneficial and the suggestion is to train lay health community workers (24). A previous study looked at mothers who were screened during the antenatal period in the clinic for depression and then followed up by CHWs during the postnatal period at and showed that rates of depression were still high (25) . Honikman et al (2020) suggests that early management through

the health system is necessary to avoid disabling the physical and mental health of not only the women in question but their children as well.

The caregivers in the settings of the previous research done in Khayelitsha and other LMICs, were exposed to many of the risk factors associated with poor maternal mental health and malnutrition, including poverty and food insecurity (12,20). Rahman *et al* (2014) suggests the need for further development of effective treatments for use by non-specialists, including lay health workers with minimal training. A review by Rahman (2014) on the integration of mental health support visits into a nutrition programme showed that there was a decline in depressive symptoms in groups that received weekly home visits and interventions, and an improvement in child development. When integrating interventions for maternal mental health into existing community health programs, the findings showed that mothers were less likely to be depressed at six months and 12 months postpartum and infants had fewer episodes of diarrhoea (24).

Current literature suggests that maternal mental health affects growth in infants (7,29) and that mental health screenings should extend further than PHC clinics into home/community based care for effective outcomes (12). Home based care is health care that patients receive in their own homes as a response to the burden on health facilities. The home-based care teams comprise of lay community health workers and nursing co-ordinators that are linked to a Primary Health Care Facility (30). In the Nomzamo area, home based care is offered to all mothers and babies who reside in the area. These mothers are followed up monthly during pregnancy and after birth, until the child is two years old, whether they present with any difficulties or not. Since the available research in South Africa and Western Cape has not extended to home based care services in the community setting, this research focusses on maternal mental health and infant growth in a PHC community receiving home based care.

The aim of this study was to describe the mental health status of mothers receiving home based care in Nomzamo, and to determine the rate of malnutrition in infants 0-24 months relative to the mother's mental health status.

Methods

Study design

A cross-sectional study was conducted on caregivers who reside in the Nomzamo area, who take care of infants between the ages of 0-24 months. These caregivers were receiving routine home based care from the Community Health Workers (CHWs) belonging to Masincedane. Routine care includes follow up visits for the mothers' recovery, feeding practices, the baby's Road-to-health-book, nutrition screening and managing any health difficulties the mother might have.

Participants were recruited from January 2020 to November 2020. Participant recruitment was halted between the months of March 2020 to September 2020 due to the South African National COVID-19 lockdown. There was no change to the manner in which the data was collected before and after the lockdown, and all safety protocols were in place to protect participants and the primary investigator.

Study setting

Masincedane is an NPO based in Strand which offers comprehensive home-based care services to the area, including to the community of Nomzamo in the Helderberg area. People in the Helderberg area receive comprehensive basic health care services in their own homes. This area is being serviced by an initiative called Community Orientated Primary Care (COPC). The focus of the COPC is to deliver services closest to the mother and child's households. The COPC model considers that the social environment influences health outcomes. This means that improvements in the health of populations cannot be made effectively without challenging the social determinants of health. The COPC approach is used in home based care and is thus part NGO and part government. They have a referral system called catch-and-match. The COPC site "catches" the patient that might require specific services and "matches" them with a primary health care facility in the area. As part of this study, the catch-and-match referrals went to the Nomzamo CDC (31,32). All infants born in the area were referred to Masincedane for basic maternal and child health home-based care services intended for infants and their caregivers. All home-based care CHWs and their nursing coordinators are linked to a Primary Health Care facility for referrals, and in this area, it is Nomzamo CDC. This area has an allocated dietitian that provides additional nutrition services. Patients who require services other than what is provided by Masincedane are referred to Nomzamo CDC.

In the PHC setting in Nomzamo the district distance between the PHC clinics and the District Hospital in Nomzamo are quite vast. There is only one MOU in the entire Helderberg region, and one NPO, one Community Day Centre and one city clinic in the Nomzamo area. Nomzamo has a population of 60 000 people with 25% of this population having matric while 3% has higher education (Statistics South Africa, 2012). As reported in the census of 2012, 31% of this population has female headed households and 19% of this population receives no income. . In this population, there is a mixture of Black African and *Mixed Ancestry/Coloured people. The referral to racially classifying terms in this study has been used as defined in the Employment Equity Act No.55 of 1998 (33) Although the main language is Xhosa, Afrikaans is also spoken and understood

Study sample

A sample of 50 caregiver-infant dyads was sourced from the Masincedane Home-based Care Programme. The sample included infants aged 0-24 months and their primary caregivers who received home based care services from Masincedane in Nomzamo during the time data collection took place. The data collection was conducted in English with the option of a CHW acting as a translator if needed. The CHWs educated caregivers during routine home visits on the research prior to data collection and those that were interested were recruited and referred to the primary researcher.

Primary caregivers (18 years and older) in the Nomzamo area who have infants (0-24 months old) who are born without medical complications that could interfere with growth were included in the study. Infants with Downs Syndrome and Cerebral Palsy were excluded from the study because these children use different growth charts and therefore anthropometry cannot be compared to children who use standard WHO growth charts. These children were also more at risk of malnutrition due to their medical conditions.

Data collection

The primary investigator received referrals for interested participants and visited them at home as part of routine Home Based Care that the caregiver and baby received. The CHW responsible for the caregiver and baby as well as the dietitian accompanied the primary researcher on the visit. The study was explained again before interested participants signed the consent form and

data collection commenced. The anthropometric measurements were taken first followed by the mother's mental health screening. All data was collated and stored in an Excel spreadsheet. Each caregiver/baby received a unique identifier to retain anonymity.

Measures

The primary researcher (MJ) performed the anthropometric measurements of weight and height using an electronic scale and length mat. The CHW and NPO dietitian conducted the MUAC screening, an additional measurement used regularly in HBC to identify possible malnutrition. Anthropometric measurements was plotted in the Road-to-Health-Book (RtHB). In addition to anthropometric measurements, a 24 hour recall and a food frequency questionnaire was done to determine dietary trends of the infants in the sample.

Anthropometric data

Information from the RtHB was used as well as anthropometric measurements i.e. weight (Wt) using a calibrated baby scale and length/height (Ht) using a length mat, and mid upper arm circumference (MUAC) using a non-stretch measuring tape. All equipment used was cleaned and wiped down with sanitizer after each participant. All measurements were explained to the mother. The anthropometric measurements was taken by MJ and plotted on WHO growth charts for record purposes.

Z-score (standard deviation)	**Weight –for-age**	**Length – for age**	**Weight –for -height**
+3SD			obese
+2SD			overweight
0 SD	Median	Median	Median
-2SD	underweight	stunted	wasted
-3SD	Severely underweight	Severely stunted	Severely wasted

24 hour recall and food frequency questionnaire

A 24-hour recall is a dietary assessment tool that is used to ask structured questions which help participants to recall all food and drink they have consumed in the previous 24 hours. For the purpose of this study, the 24 hour recall of the infant was recorded but the mother/caregiver provided the information. For the purpose of this study, a FFQ was used to determine frequencies of food and beverage consumption over a period of 1 week.

Patient Health Questionnaire-9 (PHQ-9)

The PHQ-9 is an instrument used in diagnosis of common mental disorders (Spitzer et al 1999). The total score is calculated by adding each questions score and participants are asked 9 questions in total. Total scores of 5, 10, 15, and 20 represent cut-off points for mild, moderate, moderately severe and severe depression, respectively. An important note to remember is that question 9 is a single screening question on suicide risk. A patient who answered yes to question 9 required further assessment for suicide risk by an individual who is competent to assess this risk. Screening was done by MJ and any at risk mothers were referred to the Mental Health practitioner at Nomzamo CDC. The PHQ-9 has been validated in various settings including South Africa.

Generalized Anxiety Disorder 7 (GAD 7)

GAD7 is a brief screening tool for anxiety). It has 7 questions and another final question that relates to difficulty performing tasks. The total score is calculated by adding the score from each question. Total score for the seven items ranges from 0 to 21. Scores represent: 0-5 mild, 6-10 moderate, 11-15 moderately severe anxiety, 15-21 severe anxiety. Additionally, scores of 0, 1, 2, and 3, are assigned to the response categories of "not at all," "several days," "more than half the days," and "nearly every day," respectively.

Common Perinatal Mental Disorders (CPMD)

The screening tool for Common Perinatal Mental Disorders was used to screen for anxiety/depressive symptoms. This tool was developed in Cape Town, South Africa as part of the perinatal mental health project and was validated to be used by non-specialist health providers, like CHW's (34). The suggested scoring guide states that if a participant has a score of 2 or more out of 3 then referral for mental health support from Nomzamo CDC is needed. However, if 1 out of 3 is scored on basis of the suicidality item then referral for assessment is still required.

Data analysis

Demographic and clinical data was summarised as means with standard deviation (SD) for continuous variables and as counts with percentages for categorical variables. Suitable inferential statistics was used to test for differences in demographic and clinical characteristics between infants with or without mothers with mental illness. Parametric (such as t-tests) or non-parametric (such as Mann-Whitney U) tests was used to test for differences in continuous variables, while Chi-squared or Fisher's exact test was used to test for differences in categorical

variables. All analyses was performed using SPSS, version 25 (IBM Corp., Armonk, N.Y., USA). Statistically significant differences was established at $p < 0.05$.Anthropometric data of weight-for-age, height-for-age and weight-for-height was analysed using the WHO-anthro programme

Ethical considerations

Ethical approval was obtained from the Health Research Ethics Committee of Stellenbosch University (ref #:S19/08/158). The study was also approved by the Management of Masincedane NPO. Participation was voluntary and all participants provided written informed consent. All data were anonymised to ensure privacy and confidentiality of participants' personal information, with each participant assigned a unique identifier.

Results

The aim of this study was to determine the mental health status of caregivers receiving home based care in Nomzamo and to determine what the rates of infant malnutrition was in relation to their mental health status. A sample of 50 caregiver-infant dyads was included in the final analysis.

Table 1 describes the socio-demographic and clinical characteristics of the mothers. In this sample, the mean (SD) age of the mothers was 29 (7.29) years and 60% of the mothers had more than 3 children. Only 28% of the caregivers had completed grade 12 and 76% received state grants as their main source of income. Thirty nine percent of caregivers were single, 34% were married and 24% were in a relationship. Most (43%) mothers used exclusive formula feeding, while only 35% of mothers exclusively breastfed their infants.

Table 1: Clinical and socio-demographic characteristics of the mothers.

	Mean (SD)	N (%)
Age (years)	29 (7.293)	
Number of children		
1		10 (20)
2		10 (20)
≥3		30 (60)
Highest level of education		
None		1 (2)
Primary		3 (6)

Secondary	29 (58)
Grade 12	14 (28)
Tertiary	2 (4)
Missing[$]	1 (2)
Primary language	
English	1(2)
Afrikaans	8(16)
Xhosa	41(82)
Marital status	
Single	19(39)
Married	17(35)
In a relationship	12(24)
Divorced/widowed	1(2)
Monthly income	
No income	6(12)
R0-R2000	4(8)
R2001-R4000	2(4)
State grant	38(76)
Feeding practice (infants 0-6 months)	
Exclusive breastfeeding	17(34)
Exclusive formula feeding	21(43)
Mixed feeding	11(23)
PHQ 9 symptoms	
Symptoms (>5)	11(22)
No symptoms	39(78)
GAD 7 symptoms	
Symptoms	7(14)
No symptoms	43(86)
Referral for suicidal tendencies*	9(18)
No referral	41(82)

*Mothers who had a CPMD score of 2 or more was referred to the CHC for mental health services. However mothers who had answered yes to suicidal tendencies were referred as well for urgent care.

[$] Missing data – there was 1 mother who had two infants in the sample

Mental health screening

In this sample we found that 14% of the mothers experienced symptoms of anxiety and 22% experienced symptoms of depression. Eighteen percent of mothers were reported as suicide risk, where they had experienced thoughts of suicide in the 14 days prior to the screening.

Mothers who had suicidal risk were referred to Nomzamo CDC via the catch-and-match programme. The CHW responsible for the mother accompanied her to the CDC for further mental health assistance.

Table 2 reports on the socio demographic and anthropometric characteristics of the infants. Weight-for-age, height-for-age and weight-for-height z-scores were interpreted using the WHO growth charts and validated using the WHO-anthro programme. In this sample the mean age of the infants was 9 (±7.73) months, and the mean birth weight was 3.2 (±0.61) kg. The mean current weight and height was 8.3 (±3.24) kg and 69 (±11.64) cm, respectively. The majority (86%) of the infants had a normal weight-for-age z-score and 92% of the infants had a normal height-for-age z-score. While 78% of infants had normal weight for height, 12% of infants were overweight and 10% were wasted.

Table 2: Socio-demographic and anthropometric characteristics of infants

Variables	**Mean (SD)**	**N(%)**
Age of gestation (weeks)	39 (1.68)	
Current age (months)	9 (7.73)	
Sex		
Male		27 (54)
Female		23 (46)
Birth weight (kg)	3.2 (0.61)	
birth length (cm)	49.9 (7.86)	
weight (kg)[Ψ]	8.3 (3.24)	
length (cm)[x]	69 (11.64)	
weight z-score		
Normal weight for age		43 (86)
Underweight		2 (4)
Severely underweight		1 (2)
+2SD		4 (8)
height z score		
Normal height for age		45 (91.9)
Stunted		1 (2)
Severely stunted		1 (2)
+2SD		2 (4.1)
weight for height z score		
Overweight		6 (12.2)
Normal weight for height		38 (77.6)
Wasted		5 (10.2)

[Ψ] The infants in this sample were weighed on an electronic scale

[x] Height was taken using a movable length mat.

It was plotted on the WHO growth charts for infants 0-60 months.

No significant associations were identified for maternal mental health status and infant malnutrition (PHQ9 vs z-score weight p=0.44, PHQ 9 vs z-score height p=0.73, PHQ9 vs z-score WFH p=0.38, GAD vs z-score weight p=0.82, GAD vs z-score height p=0.86, GAD vs z-score WFH p=0.62). There were however, several significant associations between symptoms of depression and socio-demographic factors (Table 3). There was a significant association between maternal depressive symptoms and infant male gender (p=0.046), where mothers with male infants being more likely to have depression symptoms. Mothers who were married were more likely to have symptoms of depression (p =0.005) and mothers who were more educated (in this case achieving a high school education) were significantly more likely to be depressed (p =0.025). There was also a significant association between maternal depressive symptoms and mothers who owned their own houses (p=0.016)

Table 3: Associations between maternal depression and socio-demographic factors for mothers and infants.

	Symptoms of Depression[a]	No Symptoms of depression	P-value
	PHQ-9 vs infant gender		
Male	9	18	0.046
Female	2	21	
	PHQ-9 vs accommodation		
Own	9	15	0.016
Not own	2	24	
	PHQ 9 vs mother's marital status		
Married	8	9	0.005
Not married	3	29	
	PHQ 9 vs schooling		
Primary school	4	29	0.025
High school	7	9	

[a]PHQ-9 >5 was scored as having depression, while PHQ-9 <5 was scored a s no depression.

There was also a significant association between the infant feeding practice and maternal suicide risk. In this sample, mothers who chose to exclusively formula feed were more likely to report suicidal risk compared to those who exclusively breast feed (p=0.026) or mixed fed (p=0.029).

Table 4: Associations between CHC referral and feeding practice.

	Suicidal risk[a]	No suicidal risk[a]	P-value
Exclusive breastfeeding	1	16	0.026
Formula feeding	8	13	
Exclusive breastfeeding	1	16	1.000
Mixed feeding	0	11	
Formula feeding	8	13	0.029
Mixed feeding	0	11	

[a]CHC referral was allocated to mothers who had experienced suicidal tendencies in the 14 days prior to the screening

The FFQ questionnaires and 24 hour dietary recalls were administered for all 50 infants. Results showed that 54% of infants were over the age of 6 months and they had a varied diet which included the main food groups of Carbohydrates, Proteins and vegetables. Carbohydrates included soft porridge, pap, potatoes. Proteins included chicken, red meat, beans and peanut butter. Vegetables consumed included butternut, carrots and spinach.

Discussion

The aim of this study was to describe the mental health status of mothers receiving home based care in Nomzamo and determine the presence of any associations between nutritional status and mental health symptoms in their caregivers.

Maternal Factors

Maternal mental health screening was found to be within the normal range (21-39%) for South African populations (20), and the majority of infants had a normal anthropometric classifications. There were no significant associations between maternal mental health and infant malnutrition, but there were associations found between sociodemographic factors and maternal mental health. More mothers experienced symptoms of depression (22%) than anxiety (14%) on a regular basis and 18% of this population had experienced suicidal thoughts in the 2 weeks prior to the data collection screening done. These findings are consistent with previous research done in developing LMIC countries and South Africa (12,20,35). According to a study done by Turner and Honikman in 2017, the risk factors for poor maternal mental health are more social than biological and are exacerbated by poverty. Mothers in this sample experience many of the risk factors for anxiety and depression like poverty (low income) and low levels of

education, possible inter-partner violence or lack of a partner and positive associations were found in this study

We found an association between maternal depressive symptoms and sex of the baby (p=0.046). Studies show that there is a higher chance of mothers experiencing postnatal depression when they have male babies because there are more cultural demands for a male infant (36). Witttowski (2014) suggests that these kinds of cultural expectations increases the mothers risk for postnatal depression. One study found that having a male baby also contributes to the mother feeling like she has a poorer quality of life but these authors suggest further research is needed on this concept (37).

We also found an association between maternal depression and mothers owning their own houses (p=0.016). This suggests the possibility that mothers who were home owners were more likely to experience depressive symptoms, which could be due to the stress and responsibility of debt and running a household. The stress of the financial responsibility has been shown to be the strongest socioeconomic predictor of depression (38). This can be linked to the socio-economic status of this sample as 76% of the mothers rely on the state grant as their main source of income and socio economic hardship has been shown to be associated with maternal depression (38).

Only 34 % of mothers in this sample were married with the majority of the mothers being single. Where there was a father, he did not necessarily live in the household with the child. In fact, many of the mothers lived with their own mothers who assisted them in taking care of the infants. It should be noted that despite this research taking place during a global pandemic, none of the mothers indicated that this was a cause of their stress, worry or anxiety. We noted a significant association between depressive symptoms and marital status (p=0.005). A possible reason for this association is that married woman are more likely to experience poor mental health because either they struggle with adjusting to a new environment, they lose their sense of self or they have a different reality to what they were expecting (39). The quality of the relationship may also contribute to the severity of the depression i.e. how good or bad the marital relationship is (40). Evidence from a study done in Nigeria suggests that where there were mothers who experienced depression, this had a negative effect on their marital relationship (41).

The majority of the mothers in this sample had a secondary education and when compared to previous studies done in Khayelitsha and Brazil, secondary education has been considered a risk factor for poor mental health (5,12). Tsai and Tomlinson (2014) and other authors suggests that having a secondary level of education is a risk factor for poor maternal mental health because this decreases the mothers' opportunity to achieve a better socio-economic status. There was also a significant association between depressive symptoms and having high school as a highest level of education (p=0.025). This indicates that mothers are more likely to have depressive symptoms if they completed high school. This suggests that these caregivers who have not completed a tertiary level of education are more likely to be unemployed (28) . Women living in poverty with low levels of education are more likely to generate less income, remain in poverty and become stigmatized or isolated (28).

When looking at suicidal risk we found two associations to be statistically significant. The first association showed that mothers who chose to formula feed instead of breastfeed were more likely to experience a suicidal risk (p=0.026). Studies show that mothers who formula feed are more at risk of experiencing mood symptoms, possibly due to the compromised levels of oxytocin being released in their body which is normally high via breastfeeding and which positively impacts the mothers' moods (42). In addition to this we found an association that mothers who chose to formula feed over mixed feeding were also more likely to experience a suicidal risk. Since mixed feeding is both breastfeeding and formula feeding, this suggests that the oxytocin hormone production is also low and mothers may experience depressive symptoms. The depressive symptoms themselves may lead to cessation of breastfeeding and thus further compromising the oxytocin response (42). The global COVID pandemic may have influenced the mothers' capacity to provide a particular type of feeding so mixed feeding in the 1st 6 months of life may have been as a result of this situation. However, 54% of the infant sample was over the age of 6 months at the time of data collection.

According to the UNICEF conceptual framework, mothers who experience poverty could follow three possible routes which could result in malnutrition in the infant (43). Malnutrition occurs due to either inadequate access to food because of low levels of income, inadequate care for the child due to poor maternal physical and mental health or limited usage of health care services. In this sample, however, we did not observe poor nourishment since the 24 hour dietary recall and Food Frequency Questionnaires showed that those infants in the sample who were older than 6 months had a diet that was varied and included all of the main food groups. The infants were well fed, and it was evident in the z-scores as well. A study was done on the

Philani model of Mentor mothers in Khayelitsha, where the manner of home based care is similar to this sample, and this research showed that there was a significant positive impact on mothers and infants receiving this care. Mothers were more likely to breastfeed and children were more likely to be well nourished (44)

Infant factors

The rates of malnutrition in this sample were lower than expected. Only 6% of infants were underweight, 4% had stunting and 10% had wasting. The low rates of malnutrition in this study are slightly different to previous studies done where malnutrition was measured in the sample. Previous studies done in South Africa and Western Cape show that there is a positive association between CPMD and malnutrition (12,21). The high rates of underweight and stunting found in previous studies could be due to the mothers' inability to properly care for herself and her infant (6,7,21,27) . In these studies, the researchers hypothesised that maternal depression affects childhood growth through interfering with the quality of emotional childcare, the mother-child attachment or negatively affecting mother's health promoting behaviours and basic childcare practices (6,7,27). There seems to be an indication that the support that CHWs provide to the mothers in this area positively contributes to the low rates of malnutrition as well as the appropriate feeding practices observed in the sample

The majority of the infants also had normal z-scores, with 86% of the sample having a normal weight for age. This is higher than previously reported in the SADHS 2016, where the prevalence of underweight was11% (19) . Although the risks factors like poverty and low levels of education could be the reason for the high levels of poor mental health in this sample, it did not drastically affect the feeding practices of the infants because we noted that the FFQ and 24 hour recall indicated that the infants had a variety of foods in their diet. In addition to this varied diet, there were low levels of undernutrition. In previous South African studies, maternal mental health was shown to impact infants' height where high rates of stunting was found (21). It must be noted that this sample of mothers was very similar to the sample of mothers in previous studies done in Khayelitsha. Weight-for-height Z scores showed that 12% of this sample was overweight and 10% was wasted with a z-score of -2SD. It is interesting to note that the prevalence of wasting was higher than that reported in SADHS which stands at 1.7%. Wasting is form of short-term malnutrition whereby the infants' weight and height are not proportioned. According to WHO, this form of malnutrition can be treated easily and it could mean that the child had recently experienced some form of weight loss due to an infection or diarrhoea i.e. may or may not be due to the poor maternal mental health. The reason for weight

loss was not part of the research questionnaire but had any cases of malnutrition been identified, it was managed by the NPO dietitian. In the SADHS the prevalence of stunting was 22%. This high prevalence is what makes stunting a public health problem. However, in this sample we found only 4% to be stunted. These results are unexpected because other literature has shown that infants of mothers who have poor mental health are malnourished (6,7,21).

A potential reason for the low levels of underweight and stunting in this sample could be due to the fact that these mothers receive comprehensive home-based care in their households. They are visited regularly from the time they are discharged from the birthing site until the child is two years old. There is available evidence that suggest that integrated home-based care provides support to mothers and the findings show that in these mothers, symptoms of depression decreased as well as infants having fewer episodes of diarrhoea and therefore improved nutritional status (35,45). A study done in Kenya on the socio demographic characteristics of community workers showed that female community health workers (CHWs) are better suited to undertake maternal, new born, child health and nutrition services because they enable and counsel clients better than male counterparts (46). The CHWs in this setting are all female and they are provided with adequate training to counsel and enable their clients appropriately (30).

Home Based Care

Due to the significant increases in the burden of diseases in South Africa, communities and non-profit organizations are increasingly taking the responsibility for health care to alleviate the stress on the health system (47). One way of doing this is the allocation of Community Health Workers (CHW's) who are trained by health care professionals and provide basic health care to their immediate community members. They, in essence, fill the gap between the local clinic and the community (47). Evidence from a study done in Pakistan suggests that these CHWs are more readily accepted if they are of similar age as mothers that they service, if they have similar sociodemographic backgrounds and if they display emotional maturity (35). At Masincedane, Community Health workers are trained by clinical professionals from the Provincial Department of Health as well as an intense Home based care programme. These CHWs first undergo training in hygiene and cleaning of which discipline is a big factor. They then undergo Home Based Care training which runs for 18 weeks. Once they have completed their HBC training package they are allowed to work in the community setting. These CHWs are volunteers from the community and service the area in which they live. This allows them to identify patients that require health care early and are able to either assist or refer more readily (30,48). This suggests that the acceptance of Community Health Workers in the mothers'

household allows her to share her experiences and struggles more openly (35). These CHWs are beneficial because they are trustworthy, show empathy and are linked to a health facility should the mother require any additional services (30). Since the caregivers in this sample are exposed to many of the risk factors of poverty or already experience poverty, they are at risk of poor mental health (20,28). This poor mental health puts their infants at higher risk of long-term malnutrition but that was not the case here. Therefore, we can hypothesise, based on the results, that these in-depth home visits and support visits given to the mothers by the CHWs positively contributes to the mothers mental state. We could hypothesise that the support and care provided by the CHWs helps the mother to manage her mental health and creates resilience in the situation. This may result in the mother providing the basic care for her infant, including correct feeding practices. The mother may then, despite having poor mental health, absorb the care and motivation given by the CHW, allowing her to continue caring for her infant in an appropriate manner. According to the South African Child Gauge (2020), the mentor mother programme in Khayelitsha is an effective response to undernutrition, with the data showing that the rate of CPMD's in Khayelitsha being higher than that of this sample. The outcome of this mentor mother programme in Khayelitsha showed that when mothers receive the kind of support given by CHWs in an under resourced setting, they are more likely to breastfeed, are more compliant, and their children are well nourished (44). In the Khayelitsha sample, the care given in the mentor mother programme is the same care given by Masincedane NPO to all patients, not just the mothers. The Food Frequency Questionnaire is an indication that despite the poor mental status of some of the mothers in this sample, feeding was not neglected and the mothers' ability to care for her infant was not inhibited. Tsai and Tomlinson (2014) suggested that there is a great need to implement mental health screenings into existing programmes that extend into the community settings. Although mental health screenings are not a part of the HBC model for this NPO, the support visit of the CHW is positively contributing to this service.

In addition to the HBC model, it can be added that the concept of resilience seems to be a part of the infants in this sample. Resilience is defined as being a class of phenomena characterized by good outcomes despite serious threats to adaptation or development (49). According to Masten (2001), risk factors for poor developmental outcomes could include the child of a parent who has poor mental health, low socio-economic status and exposure to maltreatment or violence. These have all been proven as statistical predictors of developmental problems and two of the three risk factors are evident in this sample. In the available research on resilience, the authors continue to verify the importance of relatively small set of global factors that are associated with resilience. These include but are not limited to, connections to a competent and

caring adult, whether this adult comes from the family or the community, cognitive and self-regulation skills, positive views of self and motivation to be effective in the environment (49). In this setting, the CHW acts as another competent adult to the mother and infant. Although the support is limited to a branch of clinical services, the visits at home positively contribute to mental health support. This allows for prompt management of maternal mental health and benefits both the mother and the infant (20). The South African Child Gauge (2020) also suggests that a partnership is formed between the mothers and CHWs. These mothers are followed up from pregnancy up until the child reaches 2 years old. This is almost the entire 1st 1000 days. The benefit of the CHW might not be directly linked to the mental health of the mother but it benefits the child indirectly. The partnership formed could enable the mother to improve her behaviour when it comes to caring for her child/family by using resources that are available to her in the community that she lives (44).

Limitations and recommendations

This research was limited to the Nomzamo area in the Helderberg district. We did not include mothers/caregivers of infants who have existing medical conditions like Cerebral palsy or Down syndrome. Evidence suggests that infants who have medical conditions from early in life are more at risk of malnutrition and their caregivers are more at risk of poor mental health. The sample size was limited to 50 mother-child dyads.

Recommendations for future research would include more in depth screening on the infant in terms of development and attachment, including infants with various medical conditions as well as a qualitative component. Further research is needed in various parts of the Cape Metropole where the health services are different, particularly in home based care. We noted relatively low levels of underweight and stunting which suggests that the early interventions added to existing home-based care programmes improves outcomes in both mothers and children. This research could be replicated in other geographical areas and the home-based care model of Masincedane could be improved.

Conclusion

In this study we found that maternal mental health rates were consistent with previous studies done in Western Cape and LMIC. The rates of malnutrition were lower than expected and this could be due to the support given by community health workers. There was no positive

associations found between maternal mental health and malnutrition in this sample. Further research is needed in this area.

Acknowledgements

We acknowledge Dr Muneeb Salie from the Department of Psychiatry, Stellenbosch University for writing assistance and technical editing. We acknowledge Mrs Mariam Salie, clinical Psychologist and Lecturer from the Department of Psychology, Stellenbosch University. We also thank the management and staff of Masincedane NPO, Marcia Torres (Dietitian), their Co-ordinators and Community Health workers

Funding

This study was made possible by an educational bursary from the Harry Crossley Foundation

Conflict of interest

The authors declare that they have no competing interests.

References

1. Project T hunger. No Title [Internet]. 2010 [cited 2021 Feb 5]. Available from: https://www.thehungerproject.org.uk/hillary-clinton-launches-1000-days-movement/#:~:text=US Secretary of State Hillary,movement to reduce child undernutrition.&text=Secretary Clinton emphasised the website's,of children throughout the world.
2. Thousanddays. Thousand days [Internet]. 2019. Available from: https://www.unicef-irc.org/article/958-the-first-1000-days-of-life-the-brains-window-of-opportunity.html
3. Moore T, Arefadib N, Deery A, West S. The First Thousand Days: An Evidence. 2017;(September). Available from: www.rch.org.au/ccch
4. Turner RE, Honikman S. Maternal mental health and the first 1 000 days. South African Med J. 2017;106(12):1164.
5. Santos IS, Matijasevich A, Domingues MR, Barros AJD, Barros FCF. Long-lasting maternal depression and child growth at 4 years of age: A cohort study. J Pediatr. 2010;157(3):401–6.
6. Wemakor A, Mensah KA. Association between maternal depression and child stunting in Northern Ghana: a cross-sectional study. BMC Public Health. 2016;7.
7. Avan B, Richter LM, Ramchandani PG, Norris SA, Stein A. Maternal postnatal depression and children's growth and behaviour during the early years of life: Exploring the interaction between physical and mental health. Arch Dis Child. 2010;95(9):690–5.
8. American Psychiatric Association 2013. 3. American Psychiatric Association: Diagnostic and Statistical Manual of Mental Disorders: Diagnostic and Statistical Manual of Mental Disorders. 5th ed. Washington, DC; 2013.
9. Herba CM, Glover V, Ramchandan PG, Rondon MB. Maternal depression and mental health in early childhood: an examination of underlying mechanisms in low-income

and middle-income countries. The Lancet Psychiatry [Internet]. 2016;3(10):983–92. Available from: http://dx.doi.org/10.1016/S2215-0366(16)30148-1%0Ahttp://files/147623/The Lancet Psychiatry 2016 PhD.pdf

10. Mckenna A, Abrahams Z, Marsay C, Honikman S. Screening for Common Perinatal Mental Disorders in South Africa. 2017; Available from: www.pmhp.za.org
11. Fisher J, Cobral de Mello M, Patel V, Rahman A, Tran T, Holtom S, et al. Prevalence and determinants of common perinatal mental disorders in women in low- and lower-middle-income countries: a systematic review. Bull World Health Organ. 2012;90:139–49.
12. Tsai AC, Tomlinson M. The case of perinatal depression in Khayelitsha , South Africa. 2014;2(1):1–7.
13. Baron EC, Hanlon C, Mall S, Honikman S, Breuer E, Kathree T, et al. Maternal mental health in primary care in five low- and middle-income countries: A situational analysis. BMC Health Serv Res [Internet]. 2016;16(1). Available from: http://dx.doi.org/10.1186/s12913-016-1291-z
14. Chaitkin M, Blanchet N, Su Y, Husband R, Moon P, Rowan A, et al. Integrating Vertical Programs into Primary Health Care. 2018;1–26. Available from: https://r4d.org/resources/integrating-vertical-programs-into-primary-health-care-a-decision-making-approach-for-policymakers/
15. Kusack S. The-first-1000-days-of-life-the-brains-window-of-opportunity. 2019.
16. Bhutta ZA, Lucas JE, Stenberg K, Behrman JR, Darmstadt GL, Heymann J, et al. Investing in the foundation of sustainable development: pathways to scale up for early childhood development. Lancet. 2016;6736(16).
17. WHO 2018. World Health Organization International, news/fact sheets/detail/malnutrition. 2018.
18. Sahoo K, Sahoo B, Choudhury AK, Sofi NY, Kumar R, Badhoria AS. Childhood

Obesity: Causes and consequences. Fam Med Prim Care. 2015;4:5.

19. Lehohla P. South African Demographic Health survey. Pretoria, South Africa; 2016.

20. Honikman S, Sigwebela S, Schneider M, Field S. Perinatal depression and anxiety in resource- constrained settings : interventions and health systems strengthening. 2020;79–88.

21. Madlala SS, Kassier SM. Antenatal and postpartum depression: Effects on infant and young child health and feeding practices. South African J Clin Nutr [Internet]. 2018;31(1):1–7. Available from: http://doi.org/10.1080/16070658.2017.1333753

22. Western Cape Government. National guideline on home-base care / community-based care. Westerncape.gov.za [Internet]. 2013;(Cc):22–6. Available from: http://www.westerncape.gov.za/text/2003/define_homebased.pdf

23. Khuzwayo LS, Moshabela M. The perceived role of ward-based primary healthcare outreach teams in rural KwaZulu-Natal, South Africa. African J Prim Heal Care Fam Med. 2017;9(1):1–5.

24. Rahman A, Surkan PJ, Cayetano CE, Rwagatare P, Dickson KE. Grand Challenges: Integrating Maternal Mental Health into Maternal and Child Health Programmes. PLoS Med. 2013;10(5):e1001442.

25. Lund C, Schneider M, Garman EC, Davies T, Munodawafa M, Honikman S, et al. Task-sharing of psychological treatment for antenatal depression in Khayelitsha, South Africa: Effects on antenatal and postnatal outcomes in an individual randomised controlled trial. Behav Res Ther [Internet]. 2020;130(September 2019):103466. Available from: https://doi.org/10.1016/j.brat.2019.103466

26. Tomlinson M, O'Connor MJ, le Roux IM, Stewart J, Mbewu N, Harwood J, et al. Multiple Risk Factors During Pregnancy in South Africa: The Need for a Horizontal Approach to Perinatal Care. Prev Sci. 2014;15(3):277–82.

27. Surkan PJ, Kennedy CE, Hurley KM, Black MM. Depresión materna y crecimiento

durante la primera infancia en los países en vías de desarrollo: Revisión sistemática y metaanálisis. Bull World Health Organ. 2011;89(8):607–15.

28. Turner RE, Honikman S. Maternal mental health and the first 1 000 days. South African Med J. 2016;106(12):1164–7.

29. Richter LM. The importance of caregiver-child interactions for the survival and healthy development of young children. Dept Child Adolesc Heal Dev [Internet]. 2004;1–95. Available from: http://apps.who.int/iris/bitstream/handle/10665/42878/924159134X.pdf;jsessionid=0B7442DEC049B15D66A0C5347F7A571F?sequence=1

30. Schneider H, Besada D, Sanders D, Daviaud E, Rohde S. Ward-based primary health care outreach teams in South Africa : developments, challenges and future directions: review. South African Heal Rev. 2018;2018(1):59–65.

31. Mash B, Ray S, Essuman A, Burgueño E. Community-orientated primary care: a scoping review of different models, and their effectiveness and feasibility in sub-Saharan Africa. BMJ Glob Heal. 2019;4(Suppl 8):e001489.

32. Bam N, Marcus T, Hugo J, Kinkel H-F. Conceptualizing Community Oriented Primary Care (COPC) – the Tshwane, South Africa, health post model. African J Prim Heal Care Fam Med. 2013;1.

33. South African Department of Labour. Employment Equity Act. Arbeit + R. 1994;(12):448–50.

34. Abrahams Z, Schneider M, Field S, Honikman S. Validation of a brief mental health screening tool for pregnant women in a low socio-economic setting. BMC Psychol. 2019;7(1):1–11.

35. Atif N, Lovell K, Husain N, Sikander S, Patel V, Rahman A. Barefoot therapists: Barriers and facilitators to delivering maternal mental health care through peer volunteers in Pakistan: A qualitative study. Int J Ment Health Syst. 2016;10(1):1–12.

36. Wittkowski A, Gardner PL, Bunton P, Edge D. Culturally determined risk factors for postnatal depression in Sub-Saharan Africa: A mixed method systematic review. Vol. 163, Journal of Affective Disorders. Elsevier B.V.; 2014. p. 115–24.

37. De Tychey C, Briançon S, Lighezzolo J, Spitz E, Kabuth B, De Luigi V, et al. Quality of life, postnatal depression and baby gender. J Clin Nurs. 2008;17(3):312–22.

38. Reading R, Reynolds S. Debt, social disadvantage and maternal depression. Soc Sci Med. 2001;53(4):441–53.

39. whiteswan organization. Can marriage affect a woman's mental health [Internet]. 2017. p. 1. Available from: https://www.whiteswanfoundation.org/gender/women/can-marriage-affect-a-womans-mental-health

40. Munch S, Niemczyk K. Predictors of Maternal Depression in the First Year Postpartum: Marital Status and Mediating Role of Relationship Quality. Soc Work Heal. 2010;49(3):227–44.

41. Odinka J, Nwoke M, Chukwuorji JC, Egbuagu K, Mefoh P, Odinka P, et al. Post-partum depression, anxiety and marital satisfaction: A perspective from Southeastern Nigeria. South African J Psyciatry. 2018;24.

42. Pope CJ, Mazmanian D. Breastfeeding and postpartum depression: An overview and methodological recommendations for future research. Depress Res Treat. 2016;2016.

43. UNICEF ' s approach to scaling up nutrition. 2012;

44. Simelane KS, Worth S. Food and Nutrition Security Theory. Vol. 41, Food and Nutrition Bulletin. 2020. 367–379 p.

45. A. R, R. H, J. B. Can maternal depression increase infant risk of illness and growth impairment in developing countries? Child Care Health Dev [Internet]. 2002;28(1):51–6. Available from: http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L34814886%0Ahttp://dx.doi.org/10.1046/j.1365-

2214.2002.00239.x%0Ahttp://sfx.library.uu.nl/utrecht?sid=EMBASE&issn=03051862&id=doi:10.1046%2Fj.1365-2214.2002.00239.x&atitle=Can+matern

46. Crispin N, Wamae A, Ndirangu M, Wamalwa D, Wangalwa G, Watako P, et al. Effects of selected socio-demographic characteristics of community health workers on performance of home visits during pregnancy: a cross-sectional study in Busia District, Kenya. Glob J Health Sci. 2012;4(5):78–90.

47. Moshabela M, Sips I, Barten F. Needs assessment for home-based care and the strengthening of social support networks: The role of community care workers in rural South Africa. Glob Health Action. 2015;8.

48. Masincedane. Masincedane Community Service [Internet]. 2020 [cited 2021 Jan 25]. Available from: https://www.masincedane.com/

49. Masten AS. Ordinary magic: Resilience processes in development. Am Psychol. 2001;56(3):227–38.

Appendix A – Journal guidelines

Appendix B – Ethics approval

Appendix C – Data collection tools